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PERSONNEL ADMINISTRATION.—*Some aspects of the classification of professional and scientific positions.*[1] WM. H. MCREYNOLDS, Personnel Classification Board. (Communicated by HUGH L. DRYDEN.)

In 1923 Congress passed an act to provide for the classification of civilian positions in the Government service in the District of Columbia on the basis of their duties and responsibilities and for the allocation of such positions to the appropriate levels of the compensation schedules prescribed in the act. The law defines the general standards by which positions are to be evaluated. An administrative agency, the Personnel Classification Board, is charged with measuring individual positions in terms of these standards and allocating them to their proper places in the classification plan.

The Classification Act groups related types of work, across organizational lines, in broad divisions known as "services." Positions now under the Classification Act of 1923 are grouped in five services: The Professional and Scientific Service; the Subprofessional Service; the Clerical, Administrative, and Fiscal Service; the Custodial Service; and the Clerical-Mechanical Service. The Professional and Scientific Service contains somewhat over 5,000 departmental positions allocated in nine grades or zones of difficulty and responsibility, with salaries ranging from $2000 to $9000 and above.

The variety of professional, scientific, and technical positions in the Government service is surprising, invariably so to one not familiar with the service as a whole. These positions embrace practically every branch of subject matter covered by university curricula and, moreover, many branches peculiar to the public service. In addition

[1] Received April 26, 1932. This paper, which was originally presented before the scientific group of the Department of Agriculture, is believed to be of interest to members of the Academy.

to this wide scope of subject matter, the professional and scientific positions are as a group characterized by a considerable variety of functional applications of the same subject matter. For example, in one of the agricultural sciences we may note functions of research, regulation, or demonstration and extension; and in engineering we may observe project-investigation, design, construction, inspection, testing, research, and operation, as well as administration and regulation.

In view of the variety and scope of professional and technical positions, it is clear that without certain principles of classification to guide us in evaluating and interpreting the facts about individual positions as they are presented to us from day to day, we could not even closely approach the goal of allocating these positions uniformly in the various grades. The basic principle of the Classification Act seems very simple. It is that all positions are to be classified or allocated on the basis of the importance and difficulty of their duties and responsibilities. Yet there is a corollary to this that is occasionally misunderstood, even today. That corollary has to do with the relationship of the qualifications of the present incumbent of a position to the allocation of that position.

Confusion on this score always arises when a grade allocation is thought of, not as an appraisal of the position occupied by an employee, but as an appraisal of the employee himself. It is easy to see why some professional and scientific workers might accept this as the orthodox idea, because of the emphasis placed by scientific individuals and societies upon the qualifications, standing, and accomplishment of the individual, the actual position occupied being regarded as merely one item of evidence pointing toward the achievement of the employee. Following the same line of thought, it would be natural, then, to think that the purpose of an allocation is to recognize the employee's achievements over a long period of years and his present standing in his profession, without analyzing closely the tasks or the responsibilities of the employee in the Government service at the time the allocation is being considered. The emphasis, however, should be in the other direction. The allocation is a recognition of the current tasks and responsibilities of the employee, and if it has so happened that these tasks and responsibilities have been assigned to him or have gradually developed because of his professional standing and ability, then in a certain sense it recognizes him also; but the allocation is an appraisal of the position, not of the employee. We sometimes speak in everyday parlance of a P-5[2] chemist, or a P-6 engineer, but what we mean is that here is a

[2] This is a symbol representing grade 5 of the Professional and Scientific Service. Grade 1 is the lowest grade of this service and grade 9 the highest.

chemist who is occupying a P-5 position or an engineer who has a position of P-6 level. As a matter of fact, it is readily conceivable that a chemist who has P-5 qualifications may be assigned to a P-3 position, because, for instance, no other assignment is available. He would then be a P-5 chemist on a P-3 position and would consequently receive a salary within the P-3 range. Considering the matter broadly, two things have to coincide in order for an employee to receive a salary within the range of a particular grade. First, (this is the item which is occasionally lost sight of) he must be assigned to work of that grade; and second, he must possess at least the minimum qualifications for that grade. Obviously a college graduate assigned to simple clerical work would not receive a P-1 salary. This illustrates the familiar statement that the Classification Act provides for a classification of positions and not for a classification of the employees occupying them.

In order to appreciate the significance of this statement, it is necessary to realize that in personnel administration—not only in the Government service, but generally—a sharp distinction is made between a position and an employee. A position is composed of one or more tasks or assignments that are to be performed by a single individual. It comes into existence through the action, authorization, or permission of the head of the department or establishment in which it is located. It may be occupied or vacant. It is characterized by its duties and responsibilities, and so long as these criteria remain the same, the position remains the same regardless of the fact that it may be occupied by different employees at different times. A position often exists before it is occupied by any one and it does not necessarily cease to exist when its incumbent is separated from it. When its duties and responsibilities materially change regardless of the cause of that change, it is a different position, calling perhaps for a different classification or allocation. Such a change may take place because of a division or merger of two or more positions, or because of a gradual development of the position caused by the growth of the employee himself. In this last situation the change generally takes place so imperceptibly that it is necessary to emphasize that the former position has been transformed into another one of different characteristics, the former one usually, but not necessarily, being regarded as having disappeared.

One of the considerations aiding in the classification of a position is the qualifications required of any incumbent for the performance of the duties and the discharge of the responsibilities involved. Qualification requirements are inferences drawn abstractly from the informa-

tion as to the duties and responsibilities, and to state them is one method of indicating how difficult or complex these duties and responsibilities are. Simple duties require little training and experience. Difficult duties require longer training and experience and demonstration of definite attainments. Statements of minimum qualifications to be required of *any* future incumbent of a given class of positions are particularly enlightening in considering the allocation of newly-created positions or vacancies. Their value lies in the fact that they have a generic significance, not a significance dependent solely on the qualifications of one person.

The difficulty is that many persons confuse the concept of qualifications required for a position—whoever the incumbent may be—with the actual qualifications possessed by some particular incumbent. Sometimes the incumbent possesses less than the required qualifications. That may be a mistake in assignment, but the allocation of the position should not be lowered so long as it is a fact that he is doing the work upon which the allocation was granted. Sometimes he possesses more than the required qualifications; but the allocation of the position should not be raised unless and until the duties and responsibilities of the position have substantially increased—a phenomenon which may be due to these higher qualifications or to any one of a number of other causes.

The fact is that duties actually performed and responsibilities actually exercised are the characteristics that serve as the basis of classication; qualifications that incumbents may happen to possess or lack do not determine the classification of their positions, although such possession or lack may be the reason why the duties and responsibilities are such as they are.

It is according to these principles that a position and its incumbent are regarded as separate and distinct for classification purposes, although, at the same time, it is recognized that one may have a strong influence on the other. In that part of the administrative organization of the Government which deals with central personnel management, there is a separation of function and authority along these same lines. It is the department and the Civil Service Commission that have the authority to appraise the employee and to designate him as eligible for a position of a particular grade. In a certain sense such action would be a classification of the employee and not of the position. With that decision the Board has nothing to do. It is its authority to appraise the position. Its jurisdiction is to see whether the position in question is composed of tasks or assignments of the requisite im-

portance, difficulty, and responsibility to characterize it as properly belonging in the grade recommended by the department; if so, the Board approves that grade; if not, the Board determines the grade which in its judgment is the correct one.

As was mentioned a moment ago, although the Personnel Classification Board is required to appraise positions and not the qualifications of their incumbents, it is easily apparent that the qualifications an employee may possess or lack can, and many times do, influence the character of the duties and responsibilities he is authorized or permitted to assume. In no type of work is this more frequent than in the field of scientific research. In administrative positions the responsibilities and the duties usually are somewhat more closely defined. There is not, as a rule, so large an opportunity for the growth of the position. In fact, some administrative positions are so circumscribed by law or administrative regulation as to render their basic characteristics only slightly responsive to the personal accomplishments of the incumbent. In the higher-grade research positions, however, it is almost invariably true that as a scientist develops, his position is allowed to develop with him, towards the final situation where the limits of its duties and responsibilities coincide with the limits of his own capabilities.

This leads us to another phase of classification that holds considerable interest for the professional and scientific group. That is the relationship between the allocation of administrative or operating positions and the allocation of research positions.

In view of the direct benefits of research to progress in the industrial and agricultural arts, it is, of course, true that national governments, in this country and elsewhere, recognize the advantages of research as a public function and encourage and foster it through appropriations from the public treasury. So we find, in the structure of our own Government, positions having the conduct of research as their main objective. These range from the junior positions with responsibility only for certain routine tests or determinations to the positions having as their main characteristic the rendering of service of unquestioned authoritativeness in a given branch of science and the maintenance of the Government's prestige in that branch.

As between pure and applied science and as among the various branches of science, no distinctions were manifested in the definition of the grades in the Classification Act. There was no indication that Congress intended to discriminate, for example, between work having as its immediate result the direct alleviation of human disease and

suffering, and work the immediate result of which might be, for the time being, only an extension of the boundaries of knowledge. As a matter of fact it would have been unwise, even if it had been practical, for Congress to attempt such a distinction, for the history of science is replete with instances where research for knowledge for its own sake has paved the way for outstanding benefits to the people.

As between research and administration, however, the original Classification Act of 1923 drew specific parallels in the fourth and fifth grades of the Professional and Scientific Service, which consisted of but seven grades at that time. These parallels indicated clearly that up to and including the P-5 grade, which then carried a salary range of $5200 to $6000, individual scientific research was intended to go hand in hand with administration of professional and scientific organizations. After that, the Classification Act indicated, administration was to proceed alone except for the company of exceptional consultation service to the head of a department. Accordingly, during the first few years of classification administration, P-5 was generally regarded as the ceiling for individual research. The Board made a few, but relatively very few, allocations of individual research positions to grades higher than the old P-5.

Under the Welch Act, in 1928, an extra grade was added to the professional levels within the Board's allocating authority, and under the operation of that Act there was to a certain extent a reappraisal of positions from P-4 onward, with an upward shifting of values. These changes in the upper levels had as one of their specific effects the liberalizing of standards of allocation for research positions. Since that time, P-7, carrying a salary range of $6500 to $7500, has been generally regarded as available for the allocation of research positions that are sufficiently unique and outstanding from a national or international standpoint to warrant special recognition. This, it may be added, is the foundation for the language used by the Board in defining grade P-7 in the classification bill recommended last year to Congress as a result of the field survey. The terms of the definition of P-7 in this bill specifically place on a parity the three functions of research, practice, and administration in professional, scientific or technical work.

It is, of course, already a familiar fact that in certain organization units within a bureau, it is not unusual—in fact, in some places, rather common—to have research positions in a division allocated in the same grade as the head of the division. This comes about in those instances where the individual research work concerned is of such a nature that supervision and review in the customary sense do not exist and that

the research worker is, as to the technical aspects of his work, virtually independent of the organization structure.

Generally speaking, it is the consensus of opinion in the professional and scientific group that the road of advancement open to the independent worker—the specialist in pure research—should be as long as that which is provided for the worker in applied science or for the official charged with the responsibility for administrative or operating activities. Although there may be differences of judgment as to what in individual research work constitutes a parity with a certain set of administrative responsibilities, and therefore differences of judgment as to how far the idea should be applied, no one can quarrel very much with the spirit of the principle itself.

The Classification Act and its amendments have recognized this principle almost in full measure, even though legislation has not yet been amended to the point of recognizing that individual research workers in any one of the more outstanding bureaus of the Government may be allocated to the same grade as the head of that bureau. It may thus be said that except as to the highest grade to which the Board is authorized to allocate positions, i.e., P-8, the assumption of administrative responsibility is not a prerequisite for any grade. I think it will be agreed that this relationship in the Government Service between the allocation of individual research positions and the allocation of administrative positions is certainly as favorable to the individual research worker as is the corresponding relation in the large corporations of private industry between the salaries of its scientists and those of its highest executives.

PALEOBOTANY.—*A new Palm from the upper Eocene of Ecuador.*[1] EDWARD W. BERRY, Johns Hopkins University.

The specimen which it is the purpose of the present note to describe was sent to me by Dr. George Sheppard of Guayaquil, Ecuador, and was collected from the upper Eocene of the Ancon district, Santa Elena peninsula, Ecuador. It is splendidly preserved as a calcification, and is undoubtedly a new species of palm fruit, and appears to belong in the genus *Astrocaryum* Meyer. It may be described as follows:

Astrocaryum sheppardi n. sp. Berry

Fig. 1.

Nut fairly large for this genus, elongated, slightly asymmetric, pointed at both ends—less sharply so proximad. Length 7.5 centimeters. Maximum

[1] Received April 12, 1932.

diameter 3.93 centimeters. Minimum diameter 3.65 centimeters. This slight departure from a circular cross section may be natural or it may be due to a slight amount of deformation during fossilization. Germinating pores three in number, round, about 6.25 millimeters in diameter, situated unusually high above the base—the distance ranging from 3.1 to 3.4 centimeters, slightly higher on the more inflated side of the fruit. The contours are rather more straight below the pores and more inflated and rounded above them. The surface is corrugated by irregular disconnected (interrupted) longitudinal ribbing, which is more pronounced proximad.

The identification of palm fruits, either fossil or recent is about as baffling as is the identification of palm wood, not because the fruits are not character-

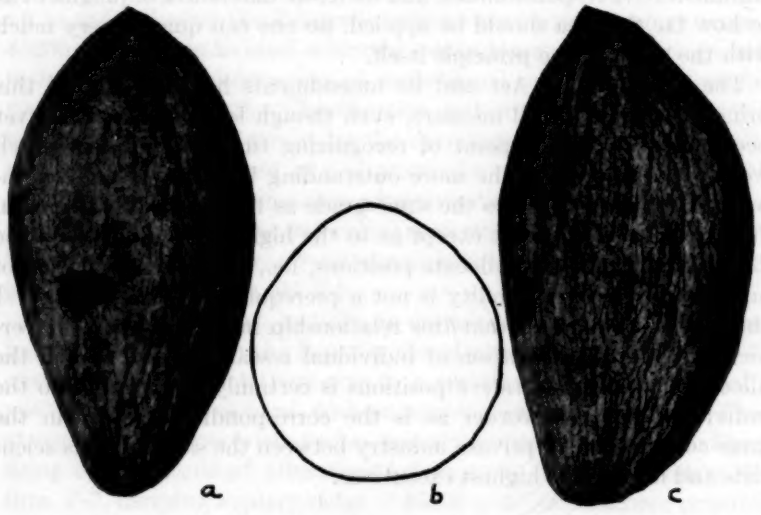


Figure 1.—(*a*) *Astrocaryum sheppardi* from the inflated side.—(*b*) Equatorial profile. —(*c*) View of side showing two of the germinating pores.

istic, but because specimens of the fruits of recent species are not available in collections nor are they particularly well described by systematic botanists even when known and often they remain unknown. Ordinarily paleobotanists evade this difficulty by referring fossil palm fruits to the purely form genus *Palmocarpon*, proposed by Lesquereux in 1878, and now containing upwards of thirty nominal species from different parts of the world. About half of these are from the Eocene of the United States. Others come from Panama, the Antilles, Ecuador, and Peru. They obviously have slight systematic value unless they show definite resemblances to existing genera.

The genus *Astrocaryum*, to which the present species from Ecuador is referred, includes stemless to tall feather palms and contains about thirty existing species. These are exclusively American and range from southern Mexico to eastern Peru, reaching their maximum development in the rain

forests of the Amazon basin, although they are also found in the Brazilian Campos. They are not especially coastal types but their fruits are common in the beach drift of both coasts of tropical America, occurring on the beaches of the Pacific coast as far south as Punta Parinas, and here derived in all probability from the Guayas estuary by the action of small inshore counter currents, although it is conceivable that they might occasionally be brought down to the sea from the head waters of the Tumbes or Chira Rivers. However, their occurrence along the north Peruvian desert coast associated with unfilled and hence floatable nuts of the Ivory palm would indicate that the former origin was the more likely.

No other fossil species of *Astrocaryum* are known to me. A few years ago I described specimens of fruits from the Oligocene of Peru which I referred to that genus,[2] but subsequent collections proved them to belong to the related genus *Attalea* H. B. K.,[3] which has about as many existing species and a somewhat similar geographical distribution. The fruits of the latter, however lack germinating pores and hence can be readily discriminated from the fruits of *Astrocaryum* when the material is well preserved.

The geological section on the Santa Elena peninsula of western Ecuador is much like that so thoroughly described by Olsson and Iddings in the northwestern coastal region of Peru, and the older Tertiary of the two regions has already yielded a number of identical fossil fruits. This number is likely to be much increased by more detailed collecting in the Ecuadorian region.

[2] Berry, E. W., U. S. Nat. Museum Proc. **70**: Art. 3. 1926.
[3] Berry, E. W., Pan Amer. Geologist, **51**: 242, figs. 4–10. 1929.

ENTOMOLOGY.—*Four new North American species of* Bassus Fabricius (*Hymenoptera, Braconidae*), *with notes on the genotype.*[1] C. F. W. MUESEBECK, Bureau of Entomology. (Communicated by HAROLD MORRISON.)

In my treatment of the Nearctic Braconinae[2] I briefly summarized the situation concerning the status of the names *Bassus* Fabr. and *Microdus* Nees. The two being isogenotypic and *Bassus* the older name, *Microdus* must be suppressed. The continued European usage of *Microdus* for this group in the Braconidae and of *Bassus* for an ichneumonid genus evidently is due to a disregard of first genotype fixation, and to the acceptance of Westwood's designation (1840)[3] of *Bassus laetatorius* Fabr. as type of *Bassus*, no notice being taken of the designation of *Ichneumon calculator* Fabr. by Curtis[4] in 1825.

[1] Received April 26, 1932.
[2] Proc. U. S. Nat. Mus. **69**: Art. 16, 1927, 73 pp.
[3] Intr. Mod. Class. Ins. **2**: 59. Gen. Syn. 1840.
[4] Brit. Ent. **2**: 73. 1825.

BASSUS CALCULATOR Fabricius

Ichneumon calculator Fabricius, Suppl. Entom. System., 1798, p. 225.
Bassus calculator Fabricius, Syst. Piez., 1804, p. 98.

Since this species was only very briefly characterized by Fabricius, and since subsequent descriptions by other authors apparently have been based merely on material identified as *calculator* and not on the type, which is in the Natural History Museum at Kiel, Germany, the following notes taken from the type specimen are included here:

A female specimen labeled "21 calculator." Agrees with the characterization of *Bassus* in my paper on the Braconinae to which reference has already been made.

Length, about 6 mm. Face not rostriform, broad, smooth; antennae missing; temples narrow, receding; frons immargined; ocelli small; mesoscutum polished; notauli sharply impressed; scutellar furrow rather broad, with several foveae within; scutellum smooth; propodeum convex, closely rugulose; mesopleural furrow curved, foveolate; metapleura mostly smooth; areolet (second cubital cell) triangular, sessile; nervulus very slightly postfurcal; mediella a little shorter than lower abscissa of basella; subdiscoidella not distinct; abdomen scarcely as long as head and thorax combined; first tergite broadening gradually behind, longer than broad, shallowly but distinctly striate, without prominent longitudinal keels; a little faint longitudinal sculpture at base of second; remainder of dorsum of abdomen smooth and shining; ovipositor sheaths very nearly as long as body. Head black; thorax black, with pronotum, mesoscutum, scutellum, and mesopleura anteriorly, red; abdomen black; anterior and middle legs yellowish, their coxae piceous; posterior legs blackish, base of tibia yellow; wings weakly infumated, with a hyaline area across discocubital cell and extending into second discoidal.

Bassus petiolatus, new species

Closely resembling *californicus* Mues., but distinguishable by the more rostriform face, weakly sculptured propodeum, mostly reddish or reddish yellow abdomen, and more slender legs.

Female.—Length, 5 mm. Head strongly produced below; malar space nearly as long as eye and nearly vertical; clypeus long, less than one and one-half times as broad as long; a low ridge on frons between antennae and below median ocellus; temples narrow; ocell-ocular line not quite twice diameter of a lateral ocellus and shorter than postocellar line; labial palpus very slender, third segment nearly half as long as second; antennae 32-segmented, a little shorter than the body.

Thorax with notauli sharply impressed, finely punctate; mesonotal lobes and scutellum smooth; scutellar furrow foveate; propodeum strongly convex, without carinae, punctate, nearly smooth medially; sides of pronotum, and mesopleura, polished; mesopleural furrow long, nearly complete, finely foveolate; metapleurum punctate; radial cell on wing margin only about one-third as long as stigma; areolet minute, long-petiolate; mediella about equal to lower abscissa of basella; posterior tibia unusually slender on basal half, scarcely thicker at middle than at base, but distinctly enlarged apically; longer calcarium of posterior tibia hardly more than one-third as long as metatarsus.

Abdomen narrower than thorax; first tergite more than one and one-half times as long as broad at apex, without longitudinal keels, and smooth and

shining except for a little faint reticulation medially; remainder of abdomen polished, second tergite longer than third and with a very weakly indicated curved transverse impression at middle; ovipositor sheaths slightly longer than body.

Head and thorax black; abdomen reddish yellow, with first tergite more or less blackish; wings uniformly infumated; legs mostly yellowish; coxae black or blackish; posterior tibia mostly infuscated, with a pale yellow streak on inner side just before middle; middle and hind tarsi blackish.

Male.—Essentially like the female; antennae of allotype also 32-segmented; posterior coxae red.

Type-locality.—Alamogordo, New Mexico.

Type, allotype, and 10 *paratypes* in Academy of Natural Sciences of Philadelphia, 11 paratypes in U. S. Nat. Museum (No. 44081, U. S. N. M.).

Eight females and fifteen males collected in April and May, 1902. The paratypes exhibit some color variation, pronotum and mesonotum sometimes becoming more or less testaceous, abdomen occasionally dark reddish rather than reddish yellow, and, rarely, all coxae brownish yellow.

Bassus parvus, new species

Most similar to *annulipes* (Cress.), but differing especially in the black coxae, the lack of longitudinal carinae on propodeum, shorter antennae, strongly oblique areolet of anterior wing, more compact abdomen, and smaller size.

Female.—Length, 2.4 mm. Head, as seen from in front, very short and broad, malar space short and very strongly inclined inwardly; eyes large; face much broader than long; third segment of labial palpus minute, scarcely discernible; antennae about as long as body, 25-segmented; temples swollen opposite middle of eyes; entire head polished.

Thorax a little narrower than head; mesonotum smooth and shining; notauli weakly impressed, punctate posteriorly, scarcely distinct anteriorly; propodeum punctate-rugulose without distinct carinae; mesopleurum polished, its furrow straight, indistinctly punctate; metapleurum shining, rugulose behind; posterior coxae polished; areolet of anterior wing minute, strongly petiolate, and oblique; second intercubitus very weak; mediella distinctly longer than lower abscissa of basella.

Abdomen about as wide as thorax and scarcely longer; first tergite a little longer than broad, closely longitudinally striate, without distinct keels; remainder of abdomen polished; second tergite with a shallow transverse curved impressed line near middle; ovipositor sheaths slender, about one and one-half times as long as abdomen.

Black; palpi piceous; all coxae black; all trochanters and femora brownish black; anterior and middle tibiae brownish; hind tibia blackish on apical half, yellowish basally, with an incomplete dark annulus a little beyond base; wings hyaline; stigma and veins dark brown.

Male.—Like the female in essential characters; antennae likewise 25-segmented.

Type-locality.—Palo Alto, California.

Type.—No. 44082, U. S. N. M.

Three females and one male reared in the Bureau of Entomology by J. M. Miller (*Hopkins* 18244*c*), from an undetermined host infesting *Cupressus macrocarpa.*

Bassus reticulatus, new species

Very similar to *perforator* (Prov.), but separable by its coarsely rugoso-reticulate propodeum, shorter antennae, which are usually 20 to 22 segmented, and longer ovipositor sheaths, which are fully as long as the body.

Female.—Length, 4 mm. Head rostriform, malar space nearly equal to eye height, nearly vertical; third segment of labial palpus about half as long as second; frons smooth, immargined; antennae but little longer than head and thorax combined, not tapering apically, 21-segmented in type.

Thorax deeper than wide; notauli wanting; mesonotum vertical in front; scutellum immargined; propodeum coarsely rugoso-reticulate, with a sharply defined median longitudinal impression from base to apex; posterior lateral angles of propodeum prominent, and the posterior declivity rather abrupt; side of pronotum faintly reticulate; mesopleurum smooth, its longitudinal furrow smooth; metapleurum minutely punctate or granular and subopaque; areolet triangular, moderately large, short-petiolate; radial cell on wing margin more than half as long as stigma; mediella about equal to lower abscissa of basella; posterior femora and tibiae short and stout.

Abdomen about as wide as thorax and slightly longer; first tergite large, about as broad at apex as long, entirely finely striato-granular, with two prominent longitudinal keels on basal half; second and third tergites transverse, subequal, closely granular and subopaque, each provided with a complete transverse groove at middle that is crossed by numerous longitudinal raised lines; second suture foveolate; third and following tergites smooth.

Honey-yellow; antennae, mesosternum, and propodeum except at apex, blackish; wings slightly brownish; legs mostly reddish yellow; trochanters, bases of anterior and middle femora, middle and posterior tibiae near base and at apex, and all tarsi, brownish black; second and third abdominal tergites with indefinite blackish markings laterally.

Male.—Antennae 22-segmented; otherwise like the type.

Type-locality.—Southern Illinois.

Type.—No. 44083, U. S. N. M.

Three females and one male collected by Charles Robertson. The antennae of both paratypes are 20-segmented and the thorax of one is entirely yellow.

Bassus brevicauda, new species

Most closely resembles *discolor* (Cresson), but differs especially in its shorter ovipositor and entirely black head and thorax.

Female.—Length, 3 mm. Head viewed from in front much broader than long, not rostriform; malar space less than half eye-height; antennae as long as body, slender, 35-segmented; third segment of labial palpus short but distinct; frons polished, immargined; ocell-ocular line slightly longer than postocellar line.

Thorax rather stout; mesoscutum weakly punctate; notauli sharply impressed throughout; scutellum smooth; propodeum mostly horizontal, with only a very short posterior declivity, entirely closely rugulose but without carinae; mesopleura mostly smooth; mesopleural furrow long and distinctly foveolate; metapleura shagreened, opaque; posterior coxae faintly shagreened and subopaque outwardly; areolet of fore wing small, triangular, subpetiolate; radial cell on wing margin less than half as long as stigma; mediella slightly shorter than lower abscissa of basella.

Abdomen scarcely longer than thorax, broadening gradually to apex of third segment; first tergite completely uniformly granular and opaque, without

dorsal keels; second and third tergites much broader than long, sculptured like the first but more weakly, the third smooth at apex; fourth and following tergites polished; ovipositor sheaths not longer than abdomen, ovipositor decurved at apex.

Black; palpi pale; legs including all coxae testaceous; posterior tibia pale yellowish, broadly black at apex and with an incomplete blackish annulus near base; middle tibia weakly infuscated at apex and near base; all tarsi more or less blackish; wings uniformly brownish; second and most of third abdominal tergites reddish yellow; the following also reddish yellow laterally, except the last which is entirely blackish; venter of abdomen testaceous.

Type-locality.—Jefferson County, W. Va.

Type.—No. 44084, U. S. N. M.

Host.—*Coleophora malivorella* Riley.

Two females reared in June and July, respectively, 1931, by Edwin Gould.

ZOOLOGY.—*A new species of* Pasiphaea *from the Straits of Magellan.*[1]

WALDO L. SCHMITT, United States National Museum.

In the course of a brief review of the species of *Pasiphaea*, I thought that the doubts that have been raised from time to time regarding the true identity of *Pasiphaea acutifrons* Doflein and Balss, Mitteil. Nat. Mus. Hamburg, vol. 29, pt. 2, p. 27, fig. 1, should be settled by recourse to the original material. Through the kindness of Dr. A. Panning of the Zoologische Staatsinstitut and Zoologische Museum, Hamburg, Germany the specimens were entrusted to me for study. I find they represent an undescribed species.

Pasiphaea dofleini, new species

Pasiphaea acutifrons Doflein and Balss, Mitteil. Nat. Mus., Hamburg, vol. 29, pt. 2, p. 27, fig. 1. (Not *P. acutifrons* Bate.)

A new species of *Pasiphaea* with very slightly emarginate telson, and non-carinated carapace and abdomen.

The compressed carapace is very little less than half the length of the abdomen and without a trace of a mid-dorsal carina, except as the back of the gastric tooth itself may be called a short carina; the tip of that tooth falls short of the frontal margin. The branchiostegal spine is situated before the angle of the sinus and near the anterior margin of the carapace but does not seem to project beyond it; the branchiostegal sinus is quite shallow.

The acicle inclusive of the spine is nearly half the length of the carapace and exceeds the antennular peduncle by about half the length of the last segment; the latter is about as long as the second and the visible portion of the first, before the eyes, taken together; the second joint is about twice as long as the visible portion of the first; the basal joint of the antenna carries a well developed spine beneath.

The meral joints of the first pair of legs are unarmed on their inferior margins, as are the ischia; the meral joints of the second legs have seven spines below in the type, but from an inspection of other specimens it appears that the count may vary from seven to ten; the basal joints, and the carpi of the second pair of legs are furnished at the infero-distal angle with a sharp

[1] Received May 7, 1932. Published by permission of the Secretary of the Smithsonian Institution.

spine; the carpus of the first legs is acute and may be somewhat produced, but does not approach the spine-like process of the second carpus either in size or length. The distal margin of the first or basal joint of the antennular peduncle, the end of the antennal peduncle, and of the carpus of the second pair of legs all attain about the same level; the first carpi, though approximately subequal to the second, reach a little farther forward, as do the first meral joints. These relative forward extensions vary in some of the specimens; in one, a specimen smaller than the one taken as the type, the meri of the second legs attain the level of the distal margin of basal joint of the antennule and those of the first legs reach a little in advance of this point.

In the type specimen the palm of the second legs is shorter than the fingers, palm 4 mm. long; longer, fixed or immovable finger 5½ mm. long; the chelae of the first pair are missing. In the first pair of legs of a smaller specimen the fingers are subequal and a little shorter than the palm, 3.2 mm. as compared to 4 mm. for the palm.

Approximate measurements of the type.—Carapace 15.2 mm. long; abdomen inclusive of telson, 71 mm.; sixth abdominal somite, 8 mm.; telson, 7 mm. The type is in the Hamburg Museum.

Type locality.—Punta Arenas, now Magelhanes, Chile.

Remarks.—This species is at once differentiated from *P. acutifrons* Bate and from *P. faxoni* Rathbun with which de Man thought it might prove identical, by the sharp longitudinal carination of the carapace, the more or less

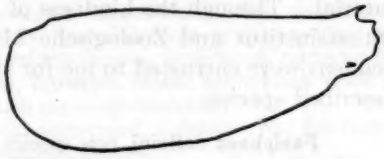


Fig. 1.—*Pasiphaea dofleini.*—Outline of carapace of type.

carinated abdomen, and the shape of the extremity of the telson which in the first named is distinctly forked and in *P. faxoni* forms a not very deep, yet a decided inverted V.

P. forceps Milne Edwards, from the Straits of Magellan, though resembling *P. dofleini* in its non-carinated carapace, is sharply differentiated by its deeply cleft telson.

From the species with which the present species might be considered to have something in common, *P. kaiwiensis* Rathbun and *P.* n. sp.? (*hilarula*) de Man, because of the very slightly emarginate telson and non-carinated carapace behind the gastric tooth itself, *P. dofleini* may be distinguished by the armature of the meral joints of the first and second legs. In the first named the merus of the first pair of legs is armed with two small spines below and that of the second with fourteen spines; in de Man's "n. sp.?" for which he proposed the name *hilarula* if sustained as a distinct species, the first merus carries a single small spinule at about the middle of the ventral margin, and the second merus three well developed spines.

P. emarginata Rathbun, whose telson exhibits a comparatively shallow Λ-shaped notch, has the carapace quite sharply carinated for the greater

part of its length and is armed with six to nine spines on the first merus, and seventeen to eighteen on the second. These spines are not all of the same size, a few are quite small, and appear with increase in size of the specimen and age to become more or less obsolescent and disappear, for in one fairly large specimen I could count but four spines on the first merus and eight on the second.

MALACOLOGY.—*The tree snails of the genus* Cochlostyla of *Mindoro Province, Philippine Islands.*[1] PAUL BARTSCH, United States National Museum.

Recent sendings of splendid collections of land shells made by Sr. Pedro de Mesa in Mindoro Province, Philippine Islands, have made it necessary to subject the Cochlostylas of the region to a critical study. This has been done, and the results are embodied in a fully illustrated monograph upon the group, submitted to the United States National Museum for publication. It seems, however, that an accumulation of manuscript will hold up its publication for some time, and since Mr. de Mesa is anxious to distribute the material, which he has collected, it appears best to publish a brief diagnosis of the new things discovered in this genus. I am therefore listing all the members of the genus so far known from the region, giving the distribution of each. A new subgenus and the new species and subspecies are tersely differentiated and their type with its United States National Museum number designated.

COCHLOSTYLA (CORASIA) AEGROTA Reeve. Mindoro.

COCHLOSTYLA (CALOCOCHLEA) MELANOCHEILA Grateloup. Eastern Mindoro.

Cochlostyla (Calocochlea) perpallida, new species. This species resembles in size and hydrophanous marking *Cochlostyla melanocheila*, but the ground color of the nuclear whorls, aperture and peristome are white; the aperture and columella are also more oblique. *Type*: U. S. N. M. No. 313568; Tubukala near San Teodora, northeastern Mindoro.

COCHLOSTYLA (CALOCOCHLEA) ROISSYANA Ferussac. This species breaks up into a number of geographic races, some of which are new. They are:

Cochlostyla (*Calocochlea*) *roissyana roissyana* Ferussac. Northeastern Mindoro.

Cochlostyla (*Calocochlea*) *roissyana bartschi* Clench. Anduyanan, Paluan, northwestern Mindoro.

Cochlostyla (*Calocochlea*) *roissyana subatra* Pilsbry. Mindoro.

Cochlostyla (*Calocochlea*) *roissyana lutea* Pfeiffer. Ilin Island, off southern Mindoro.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received May 10, 1932.

Cochlostyla (Calocochlea) roissyana cavitala, new subspecies. This race differs from *Cochlostyla* (*Calocochlea*) *roissyana bartschi* Clench in being uniformly lighter colored. *Type:* U. S. N. M. No. 313589; Mt. Calavite near Paluan, northwestern Mindoro.

Cochlostyla (Calocochlea) roissyana manlaysa, new subspecies. This race is distinguished from typical *roissyana* Ferussac by its much paler color. *Type:* U. S. N. M. No. 313614; east shore of Mansalay Bay, eastern Mindoro.

Cochlostyla (Calocochlea) roissyana laymansa, new subspecies. This race, specimens of which I collected on the west shore of Mansalay Bay, eastern Mindoro, can readily be distinguished by its pale greenish plum color. *Type:* U. S. N. M. No. 255958.

COCHLOSTYLA (CALOCOCHLEA) GERTRUDIS Möllendorff, Kobelt and Winter. Bongabon, southeastern Mindoro.

Cochlostyla (Halocochlea) lillianae, new subgenus and species. Shell helicoid, periphery angulated, curve between summit and periphery of last whorl equalling that of base between periphery and umbilicus; peristome expanded and reflected; columella very oblique and excavated. There is scarcely any calcareous material in the shell, which is thin and diaphanous, and of very pale yellowish olive green color, with a dark chestnut brown columellar area. *Type:* U. S. N. M. No. 255825; Mt. Halcon.

COCHLOSTYLA (HELICOSTYLA) FULGENS FULGENS Sowerby. Northeastern Mindoro.

Cochlostyla (Helicostyla) fulgens johnsoni, new subspecies. This subspecies is readily distinguished from the other two by its more elevated spire. It has the dark base and variable bands of typical *Cochlostyla* (*Helicostyla*) *fulgens fulgens. Type:* U. S. N. M. No. 21779; Sitio Pamulon, Mansalay Bay, southeastern Mindoro.

Cochlostyla (Helicostyla) fulgens sapolana, new subspecies. This subspecies is distinguished from typical *Cochlostyla* (*Helicostyla*) *fulgens fulgens* by its lacking the dark olivaceous yellow base. Here it is only a trifle more yellow than the spire. *Type:* U. S. N. M. No. 313574; Mt. Sapol, northeastern Mindoro.

COCHLOSTYLA (HELICOSTYLA) DIMERA Jonas. Mindoro.

COCHLOSTYLA (COCHLOSTYLA) HYDROPHANA HYDROPHANA Sowerby. Medio Island, Mindoro.

Cochlostyla (Cochlostyla) hydrophana veroderoana, new subspecies. This subspecies is readily distinguished from typical *Cochlostyla* (*Cochlostyla*) *hydrophana hydrophana* by its much more elevated form. *Type:* U. S. N. M. No. 313619; Verodero, Mindoro.

COCHLOSTYLA (COCHLODRYAS) FLORIDA FLORIDA Broderip. Northeastern Mindoro.

COCHLOSTYLA (COCHLODRYAS) FLORIDA FUSCOLABIATA Möllendorff, Kobelt and Winter. Mindoro.

Cochlostyla (Cochlodryas) florida aureola, new subspecies. This race in shape reminds one of *Cochlostyla (Cochlodryas) florida signa,* but can at once be differentiated from this by its golden yellow periostracum. *Type:* U. S. N. M. No. 313610; obtained by the U. S. Exploring Expedition, probably at the southern tip of Mindoro.

Cochlostyla (Cochlodryas) florida signa, new subspecies. This subspecies is differentiated from all the others by its exceedingly thin shell and pale olivaceous waxy coloration. *Type:* U. S. N. M. No. 313611, west shore of Mansalay Bay, southeastern Mindoro.

COCHLOSTYLA (COCHLODRYAS) FLORIDA HELICOIDES Pfeiffer. Northeastern Mindoro.

COCHLOSTYLA (COCHLODRYAS) ORBITULA Sowerby. Northeastern Mindoro.

Cochlostyla (Cochlodryas) mateoi, new name for HELIX TENERA Sowerby, 1841, Proc. Zool. Soc., p. 102, in part, not HELIX TENERA Gmelin, 1791, Linn. Syst. Nat., ed. 13, vol. 1, pt. 6, p. 3653. The dark banded shell. Northeastern Mindoro.

Cochlostyla (Cochlodryas) mateoi sibolonensis, new subspecies. This can readily be distinguished from typical *Cochlostyla (Cochlodryas) mateoi* by its very thin shell and broad form, as well as paler coloration. *Type:* U. S. N. M. No. 313629; Sibolon Island off southeastern Mindoro.

Cochlostyla (Cochlodryas) fastidiosa, new name for HELIX TENERA Sowerby, 1841, Proc. Zool. Soc. London, p. 102, in part, not HELIX TENERA Gmelin Linn. Syst. Nat. ed. 13, 1791, vol. 1, pt. 6, p. 3653. The pale shells. Northeastern Mindoro.

COCHLOSTYLA (COCHLODRYAS) DECORA Adams and Reeve. Mindoro.

COCHLOSTYLA (COLUMPLICA) CEPOIDES Lea. Lubang Island.

COCHLOSTYLA (HELICOBULINUS) TURBO Pfeiffer. Mindoro.

Cochlostyla (Orthostylus) euconica, new species. Shell broadly conic, periostracum varying from grayish brown to wood brown. Where the periostracum is removed, the early whorls are flesh colored, the succeeding turns becoming gradually darker until the last is chestnut brown between summit and periphery and bright dark chestnut brown on base. Aperture bluish white; peristome edged with brown; columella pinkish. *Type:* U. S. N. M. No. 313637; Calapan, Mindoro. It has 5.7 whorls, and measures: Length, 50.3 mm.; greater diameter, 39.2 mm.; lesser diameter, 34 mm.

COCHLOSTYLA (HYPSELOSTYLUS) CINCINNIFORMIS CINCINNIFORMIS Sowerby. Lubang Island.

COCHLOSTYLA (HYPSELOSTYLUS) CINCINNIFORMIS ULTIMA Clench. Aparico, Golo Island.

COCHLOSTYLA (HYPSELOSTYLUS) CINCINNIFORMIS DEMESANA Clench. Aparico, Golo Island.

Cochlostyla (Hypselostylus) cincinniformis menagei, new subspecies. This subspecies is distinguished from the others by its much more vivid coloration, the light areas being much more intensely white and the dark areas equally intensely dark, but the dark areas are not as broad as in typical *Cochlostyla* (*Hypselostylus*) *cincinniformis cincinniformis*; consequently the shell as a whole appears paler than in the typical race. *Type:* U. S. N. M. No. 313578; collected by the Menage Expedition in northeastern Mindoro.

Cochlostyla (Hypselostylus) cincinniformis guntingana, new subspecies. The yellow or orange coloration of the light areas in this subspecies will distinguish it from the rest. *Type:* U. S. N. M. No. 313574; Gunting Mountain, Looc Bay, Lubang Island.

Cochlostyla (Hypselostylus) cincinniformis cabrasensis, new subspecies. This subspecies is distinguished from the rest by having the brown bands much brighter and the light ones intensely bluish white. *Type:* U. S. N. M. No. 313639; Cabras Island.

Cochlostyla (Hypselostylus) cincinniformis lubanensis Clench and Archer. Binacas, Lubang Island.

Cochlostyla (Eudoxus) jonasi Pfeiffer. Mindoro.

Cochlostyla (Eudoxus) buschi Pfeiffer. Mindoro.

Cochlostyla (Eudoxus) simplex Jonas. Mindoro.

Cochlostyla (Eudoxus) albina Grateloup. Mindoro.

Cochlostyla (Eudoxus) canonizadoi, new species. This species suggests very strongly *Cochlostyla* (*Cochlodryas*) *halichlora* Semper from Luzon, but it is in every way much smaller. *Type:* U. S. N. M. No. 313722; 5 whorls; measures: Length, 27.3 mm.; greater diameter, 27.9 mm.; lesser diameter, 22.5 mm.; Sibolon Island, south of Mindoro.

Cochlostyla (Prochilus) virgata Jay. This is a most interesting mutating species, which I have fully discussed in my monograph and some of whose forms have been described as: Bulimus porraceus Jay, Bulimus labrella Grateloup, Bulimus dryas Broderip, Bulimus sylvanus Broderip, Bulimus calobaptus Jonas, Bulimus cuyoensis Reeve, in part, Cochlostyla sylvanoides Semper, Cochlostyla virgata pulchrior Pilsbry, Cochlostyla virgata alampe Möllendorff. Northeastern Mindoro.

Cochlostyla (Prochilus) cerina, new species. The medium-size and yellow color will distinguish this species from all others of the subgenus. *Type:* U. S. N. M. No. 313672; Bulalacao, southeastern Mindoro.

Cochlostyla (Prochilus) partuloides Broderip. Northeastern Mindoro.

Cochlostyla (Prochilus) cuyoensis contracta Möllendorff. Mindoro

Cochlostyla (Prochilus) cuyoensis subpallida, new subspecies. This subspecies differs from *Cochlostyla* (*Prochilus*) *cuyoensis contracta* Möllendorff in its exceedingly thin shell which permits all of the interior to be seen by

transmitted light, and in lacking the decided color bands. *Type:* U. S. N. M. No. 313671; Caluya Island, off southeastern Mindoro.

Cochlostyla (Prochilus) fictilis fulva, new subspecies. This subspecies differs from all the others known by being yellowish but in having a remnant of the basal columellar dark area. This is based upon Möllendorff, Kobelt and Winter's description and figure of *Cochlostyla* (*Prochilus*) *fictilis larvatus*, 1914, Semper's Reisen im Archipel der Philippinen, vol. X, p. 332, in part, pl. 76, figs. 11, 12. Southeastern Mindoro.

Cochlostyla (Prochilus) fictilis ambulonensis, new subspecies. This subspecies is rather large and has the white band at the summit of the whorls reduced to a minimum. *Type:* U. S. N. M. No. 313600; Ambulon Island off southwestern Mindoro.

Cochlostyla (Prochilus) fictilis marmorosa, new subspecies. This is similar to *Cochlostyla* (*Prochilus*) *fictilis ambulonensis*, but is much smaller and brighter colored. The light band at the summit is also much broader. *Type:* U. S. N. M. No. 313741; Ilin Island, off southwestern Mindoro. Its geographic position is intermediate between that of *Cochlostyla* (*Prochilus*) *fictilis ambulonensis* and *Cochlostyla* (*Prochilus*) *fictilis cagurana* and so is its color scheme.

Cochlostyla (Prochilus) fictilis cagurana, new subspecies. This subspecies is easily distinguished from the other Mindoro *fictilis* by its dark coloration and very broad light band at the summit. *Type:* U. S. N. M. No. 313598; Caguray, southwestern Mindoro.

COCHLOSTYLA (CHRYSALLIS) CHRYSALIDIFORMIS CHRYSALIDIFORMIS Sowerby. Northeastern Mindoro.

Cochlostyla (Chrysallis) chrysalidiformis macra, new subspecies. The extreme slenderness of this subspecies will distingush it from all the others. *Type:* U. S. N. M. No. 382969, Mindoro.

Cochlostyla (Chrysallis) chrysalidiformis villosa, new subspecies. This subspecies in shape and sculpture resembles most nearly typical *Cochlostyla* (*Chrysallis*) *chrysalidiformis chrysalidiformis*, but it is a little more rough and lacks the dark color band at the summit and the dark edge to the lip. It differs from *Cochlostyla* (*Chrysallis*) *chrysalidiformis enodosa* by its larger size, more elongate form and stronger sculpture. *Type:* U. S. N. M. No. 315858; Mindoro.

Cochlostyla (Chrysallis) chrysalidiformis rarior, new subspecies. The subspecies is remarkable for the extreme thinness of its shell. *Type:* U. S. N. M. No. 313644; Calawagan, Paluan, northwestern Mindoro.

Cochlostyla (Chrysallis) chrysalidiformis enodosa, new subspecies. This subspecies is nearest related to *Cochlostyla* (*Chrysallis*) *chrysalidiformis villosa*, from which it can be easily distinguished by its more ovate form and much more less strongly developed sculpture. *Type:* U. S. N. M. No. 382970; southwestern Mindoro.

Cochlostyla (Chrysallis) chrysalidiformis fuscata, new subspecies. This differs from all the other subspecies by its regularly conic spire and by having the parietal wall brown. *Type:* U. S. N. M. No. 382971; Mindoro.

Cochlostyla (Chrysallis) jayi, new name for BULIMUS USTULATUS Jay, 1839, Cat. Shells, 2d ed., p. 119, pl. 6, fig. 1; not BULIMUS USTULATUS Sowerby, 1833, Conchological Illustrations, figure 42.

Cochlostyla (Chrysallis) jayi jayi, new name. Northeastern Mindoro.

Cochlostyla (Chrysallis) jayi perpusilla, new subspecies. This subspecies differs from typical *Cochlostyla (Chrysallis) jayi jayi* in being much smaller. *Type:* U. S. N. M. No. 313685; Calawagan, Paluan, northwestern Mindoro.

Cochlostyla (Chrysallis) jayi camorongana, new subspecies. In this subspecies the ground color is blackish brown, while in the others it is bright chestnut brown. *Type:* U. S. N. M. No. 313620; Camorong, Abra de Ilog, northern Mindoro.

COCHLOSTLYA (CHRYSALLIS) LICHENIFER LICHENIFER Mörch. Mindoro.

Cochlostyla (Chrysallis) lichenifer avittata, new subspecies. This differs from typical *Cochlostyla (Chrysallis) lichenifer lichenifer* by lacking the peripheral brown band. *Type:* U. S. N. M. No. 382972 is from Mt. Halcon.

COCHLOSTYLA (CHRYSALLIS) ELECTRICA ELECTRICA Reeve. Puerta Galera, northeastern Mindoro.

Cochlostyla (Chrysallis) electrica mangarina, new subspecies. This subspecies differs from typical *Cochlostyla (Chrysallis) electrica electrica* in being more globose and in having the axial fulguration slanting retractively. It differs from *Cochlostyla (Chrysallis) electrica bulalacaoana* in being more globose and in having a less strong periostracum. *Type:* U. S. N. M. No. 382973; Sitio Brucaan, Mangarin, southwestern Mindoro.

Cochlostyla (Chrysallis) electrica bulalacaoana, new subspecies. This subspecies differs from *Cochlostyla (Chrysallis) electrica mangarina* in being less globose and in having a much stronger periostracum. *Type:* U. S. N. M. No. 382974; Bo. de Cora, Bulacao, southeastern Mindoro.

Cochlostyla (Chrysallis) palliobasis, new species. This species is most conspicuously distinguished from all the other *Cochlostyla (Chrysallis)* by having the basal half pale buff, contrasted with the chestnut coloration of the upper part of the last whorl. *Type:* U. S. N. M. No. 313653; Pinagbayan, Paluan, Mindoro.

Cochlostyla (Chrysallis) pettiti, new name for BULIMUS CAILLIAUDI Pettit, December, 1850, Journ. Conchyl., vol. 1, p. 404, pl. 13, fig. 3, not BULIMUS CAILLIAUDI Pfeiffer, August, 1850, Zeitschr. Malakozo. p. 86.

COCHLOSTYLA (CHRYSALLIS) ROLLEI ROLLEI Möllendorff. North base of Mt. Halcon, Mindoro.

Cochlostyla (Chrysallis) rollei osborni, new subspecies. This subspecies differs from typical *Cochlostyla (Chrysallis) rollei rollei* in having the shell

much more ovate and the axial bands much broader. *Type:* U. S. N. M. No. 300823; Lake Naujan, Mindoro.

Cochlostyla (Chrysallis) rollei vexator, new subspecies. This subspecies is ever so much smaller than typical *Cochlostyla (Chrysallis) rollei rollei. Type:* U. S. N. M. No. 104348; Mindoro.

Cochlostyla (Chrysallis) rollei niger, new subspecies. This subspecies differs from the other three in being ever so much darker and in having the spiral sculpture more pronounced. *Type:* U. S. N. M. No. 313721; Mayabig, Baco, Mindoro.

Cochlostyla (Chrysallis) albolabris, new species. This species is most nearly related to *Cochlostyla (Chrysallis) rollei* from which it differs in having the peristome white and the aperture proportionately larger. It is also much smaller. There are two races before me which may be called:

Cochlostyla (Chrysallis) albolabris albolabris, new subspecies. In this the shell is of elongate-ovate shape. *Type:* U. S. N. M. No. 104347; Mindoro.

Cochlostyla (Chrysallis) albolabris robusta, new subspecies. In this the shell is not elongate-ovate but ovate. *Type:* U. S. N. M. No. 104346; Mindoro.

COCHLOSTYLA (CHRYSALLIS) ANTONI ANTONI Semper. Northeastern Mindoro.

Cochlostyla (Chrysallis) antoni macilenta, new subspecies. This subspecies can readily be distinguished from *Cochlostyla (Chrysallis) antoni antoni* by its much more slender form. *Type:* U. S. N. M. No. 313551; Sitio Boncaan, Mangarin, southwestern Mindoro.

Cochlostyla (Chrysallis) roseolabra, new species. Shell varying from elongate conic to broadly ovate. General color yellowish buff or wood brown. Interior of aperture bluish white or bluish white with a purplish tinge; peristome pale or bright rose colored. There are two subspecies before me:

Cochlostyla (Chrysallis) roseolabra roseolabra, new subspecies. In this the general color of the shell is yellowish buff, while the expanded peristome is pale rose colored. *Type:* U. S. N. M. No. 313677; Calawagan, northwestern Mindoro.

Cochlostyla (Chrysallis) roseolabra rosea, new subspecies. In this the general color scheme is wood brown. The periostome is much more intensely rose colored. *Type:* U. S. N. M. No. 133680; interior from Abra de Ilog, northern Mindoro.

COCHLOSTYLA (CHRYSALLIS) ASPERSA ASPERSA Grateloup. Northeastern Mindoro.

Cochlostyla (Chrysallis) aspersa lunai, new subspecies. This is the largest subspecies, suggesting in size *Cochlostyla (Chrysallis) rollei,* from which it

can be at once distinguished by its dark apex. *Type:* U. S. N. M. No. 313702; Calamintao, Mamburo, Mindoro.

Cochlostyla (Chrsyallis) aspersa juani, new subspecies. This is the smallest of the short based subspecies. *Type:* U. S. N. M. No. 313708; Camorong, Abra de Ilog, northern Mindoro.

COCHLOSTYLA (CHRYSALLIS) ASPERSA MINDOROENSIS Broderip. Dulugan, Puerto Galera, northeastern Mindoro.

COCHLOSTYLA (CHRYSALLIS) ASPERSA MELANOGASTER Mörch. Mt. Sapol northeastern Mindoro.

COCHLOSTYLA (CHRYSALLIS) ASPERSA WAGNERI Grateloup. About Lake Naujan, eastern Mindoro.

Cochlostyla (Chrysallis) aspersa edgari, new subspecies This is the large, elongate-ovate race with rather protracted base about the east slope of Mt. Halcon. The axial bands of brown and buff are distinct and rather broad, and not interrupted at the periphery. *Type:* U. S. N. M. No. 313712.

Cochlostyla (Chrysallis) aspersa binuangana, new subspecies. This subspecies is very dark colored and of ovate form. It suggests *Cochlostyla (Chrysallis) aspersa melanogaster* but lacks the dark basal coloration. *Type:* U. S. N. M. No. 313713; Binuanga, Paluan, northwestern Mindoro.

Cochlostyla (Chrysallis) aspersa ilogana, new subspecies. This subspecies is readily distinguished from *Cochlostyla (Chrysallis) aspersa edgari* by its much more regular elongate-ovate form and from *Cochlostyla (Chrysallis) aspersa calavitana* by its much greater size. *Type:* U. S. N. M. No. 313706; Camorong, Abra de Ilog, northern Mindoro.

Cochlostyla (Chrysallis) aspersa calavitana, new subspecies. This subspecies can readily be distinguished from the other members of the group with protracted base by its exceedingly small size. *Type:* U. S. N. M. No. 313714; Mt. Calavite near Paluan, northwestern Mindoro.

Cochlostyla (Chrysallis) caniceps, new species. In this species the shell varies from elongate-ovate to elongate-conic. The nuclear whorls are flesh colored. Postnuclear whorls marked by axial bands and fulgurations of yellow or greenish yellow. Interior of aperture bluish white; peristome varying from white to brown in the different subspecies. Distribution apparently all over Mindoro, breaking up into a number of subspecies.

Cochlostyla (Chrysallis) caniceps demesai, new subspecies. This subspecies is much darker than any of the other subspecies. Here the dark color of the periostome extends within the aperture, a feature not possessed by the other races. *Type:* U. S. N. M. No. 313552; Calamintao, Mamboro, northwestern Mindoro.

Cochlostyla (Chrysallis) caniceps maita, new subspecies. This subspecies belongs to the ovate-conic group and most nearly resembles *Cochlostyla (Chrysallis) caniceps contracostana,* but it is much larger and the peristome is much darker. *Type:* U. S. N. M. No. 20351a; southern tip of Mindoro.

Cochlostyla (Chrysallis) caniceps contracostana, new subspecies. This subspecies belongs to the elongate-ovate group and can readily be distinguished from *Cochlostyla* (*Chrysallis*) *caniceps demesai* by its smaller size and less brilliant coloration, and from *Cochlostyla* (*Chrysallis*) *caniceps maita* by its smaller size. *Type:* U. S. N. M. No. 313554; Contra Costa, Mindoro.

Cochlostyla (Chrysallis) caniceps conica, new subspecies. The regularly conic outline will distinguish this subspecies from all the others. *Type:* U. S. N. M. No. 313555; southwestern Mindoro.

Cochlostyla (Chrysallis) caniceps caniceps, new subspecies. In this subspecies the shell is elongate-conic; the whorls are well rounded. It is nearest related to *Cochlostyla* (*Chrysallis*) *caniceps minuta*, but is much larger than that subspecies. *Type:* U. S. N. M. No. 313556; Lake Naujan, Mindoro.

Cochlostyla (Chrysallis) caniceps minuta, new subspecies. This subspecies is most nearly related to the typical race *Cochlostyla* (*Chrysallis*) *caniceps caniceps*, but is easily distinguished from it by its smaller size and more shaggy sculpture. *Type:* U. S. N. M. No. 313560; Mansalay, southeastern Mindoro.

Cochlostyla (Chrysallis) nigriceps, new species. The members of this species closely resemble *Cochlostyla* (*Chrysallis*) *caniceps* from which, however, they can be distinguished at once by their dark nuclear turns.

Cochlostyla (Chrysallis) nigriceps nigriceps, new subspecies. This subspecies is nearest related to *Cochlostyla* (*Chrysallis*) *nigriceps nubifer*, from which it is distinguished by its lesser size. *Type:* U S. N. M. No. 313716; Lake Naujan, northeastern Mindoro.

Cochlostyla (Chrysallis) nigriceps nubifer, new subspecies. This subspecies is nearest related to *Cochlostyla* (*Chrysallis*) *nigriceps nigriceps*, from which its larger size will readily distinguish it. *Type:* U. S. N. M. No. 195408; southwestern Mindoro.

Cochlostyla (Chrysallis) nigriceps obnubila, new subspecies. This subspecies is readily distinguished from the other two by having the general color blackish brown instead of chestnut brown. The hydrophanous cloudings are also lighter and much more pronounced. *Type:* U. S. N M. No. 313718; Binuangan, Paluan, northwestern Mindoro.

Cochlostyla (Chrysallis) perturbator, new species. Shell of medium size, ovate. Early nuclear whorls white, grading slowly into the brown of the postnuclear turns. Periostracum of the postnuclear whorls moderately thick, covered by hydrophanous bands, cloudings or fulgurations of olivaceous buff between which the dark ground color shines through. On the last whorl the periostracum is almost completely hydrophanous. Interior of the broadly oval aperture pale blue; periostracum and inner lip chocolate brown, with an iridescent flush. *Type:* U. S. N. M. No. 313720; Tara, Abra de Ilog, northern Mindoro.

Cochlostyla (Chrysallis) corrugata, new species. In this species the nuclear

whorls are flesh colored; the early postnuclear whorls are buff, while the later ones gradually range to very dark chestnut brown. The postnuclear whorls are conspicuously marked by brilliant fulgurations of yellowish buff, which are most pronounced near the summit of the shells. The interior of the aperture and inner portion of the columella are pale blue, gradually grading to purplish brown at the edge of the expanded peristome and inner lip. The most distinctive feature of the shell, however, is the axial corrugations of the last, and sometimes the penultimate, whorl. *Type:* U. S. N. M. No. 313740; San Jose, southwestern Mindoro.

ZOOLOGY.—Metoncholaimus pristiurus *(zur Strassen); a nema suitable for use in laboratory courses in zoology.*[1] N. A. COBB, U. S. Department of Agriculture.

Zur Strassen, who first proposed the species *Metoncholaimus pristiurus,* alluded for the most part only to the organs whose forms served to distinguish it from its nearest allies among the oncholaims. The present attempt at a more complete understanding of its morphology adds to our knowledge in a number of ways, especially with regard to the remarkable demanian system.

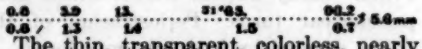
At the same time the text and figures have been prepared with particular reference to requests of school, college and university instructors in invertebrate zoology, a course suggested by the fact that this species has been used with some promise of success in the invertebrate courses of a considerable number of universities.

Unfortunately few if any zoological textbooks treat nemas adequately. It is believed that any progressive and well equipped instructor who will study carefully the following descriptions, with the aid of good *living* as well as preserved specimens, will find himself all the better equipped to instruct students concerning the morphology of the important nemic phylum.

METONCHOLAIMUS PRISTIURUS (Zur Strassen)

[*Meta,* changed; *Oncholaimus,* tooth (in the) throat]

FEMALE. Fig. 1.



The cuticle and the body wall. The *contour* of the nema is plain. The thin, transparent, colorless, nearly naked cuticle, 72, 96, about one micron thick, is traversed by plain transverse striae; but these are very difficult of resolution except with high powers of the microscope used skillfully under favorable conditions,—ordinarily they will

[1] Through the much appreciated courtesy of the United States Bureau of Fisheries a considerable part of these investigations was carried out at its Laboratories at Woods Hole, Mass. Received May 18, 1932.

not be seen. These striae are not altered on the lateral fields; there are no longitudinal wings. The subcuticle, 99, usually contains multitudinous pebbly,—i.e. roundish or slightly elongate,—*yellowish pigment granules*, 34, 82, 95, one to two microns across, "paved" in longitudinal bands of variable width;—two broad lateral bands, one on each side of the body, about one-third as wide as the nema and having narrower submedian bands on each side; and three narrow ventral bands as well as even narrower dorsal bands. These bands are better seen after staining over night in *seawater-methylene-blue*, which may not only stain them but bring out the fact that the granules along the edges of the two main lateral bands are of a somewhat different nature from the rest. *Longitudinal striations* in the subcuticle, due to the attachment of the musculature, 4, 16, 77, are faintly visible at high magnification in most regions of the body, especially the more translucent parts. The body wall, including the cuticle, is about six microns thick.

Ten widely spreading *cephalic setae*, 26, are arranged on the lateral surface of the lip region in the usual way, i.e. a pair on each submedian line and one on each lateral line; the longest of these are one-fourth as long as the corresponding portion of the head is wide, the shorter member of each submedian pair being about three-fourths as long as the longer. The members of the submedian pairs grow so close together as sometimes to appear as one. These subcylindroid setae are nearly straight and are blunt at the end, where they seem more or less *open*, not closed, indicating, probably, that they may also be connected with some sense in addition to that of touch. There are a few scattered subcephalic setae near the head, of nearly the same length (ten to twelve microns) as the cephalic setae, but more slender. On the neck and on the body there are also a few scattered setae,—very inconspicuous and seldom seen. There are also a few very short, *very inconspicuous setae* on the tail, especially toward its extremity and *on the spinneret*, 24, 74. There are no cuticular pores.

The neck and head. The head and neck occupy the anterior 11 to 13 per cent of the body, i.e. the part in front of the prominent constriction, 13, between the nearly colorless oesophagus, 12, 36, and the darker intestine, 83, 94. The slightly conoid *neck* ends in a *subtruncate continuous head*, the frontal mouth opening in which is not depressed. In front the *pharynx*, 31, 48, 57, is arched over by the six distinct and separate, flat and thin, fairly well developed, mobile *lips*, 28, 49, which are not set off by constriction or in any other way. As a rule the lips are not readily counted except when seen from in front. Toward the margin of the head there is a circlet of six, innervated, very minute and inconspicuous, *forward-facing sensory papillae*, 29, 45, one on each lip. This circlet is about two-thirds as wide as the front of the head. These papillae also are rather difficult to see except from in front, 45. The rather simple subregular *pharynx*, 31, 35, 48, 57, about forty by twenty-three microns, is somewhat cylindroid anteriorly and vaguely conoid posteriorly. The *posterior "chamber,"* 35, sixteen by nine microns, supports the *three acute onchia*, 25, 33, 53, the forward pointing projection of the largest of which is very readily seen. Taken as a whole the pharyngeal cavity might be described as somewhat convex-conoid. Its refractive, cuticularized wall is nearly two microns thick.

Its armature consists of three unequal, conoid, perforated, pointed onchia, *one dorsal*, 25, *two ventrally submedian*, 33, 53. Of these the grooved left ventral submedian, 27, 53, is much the largest, and reaches two-thirds the distance to the lips. The other two, *e.g.* 33, 25, nearly equal in size, reach only about halfway to the lips. Each onchium is the outlet of a branched and

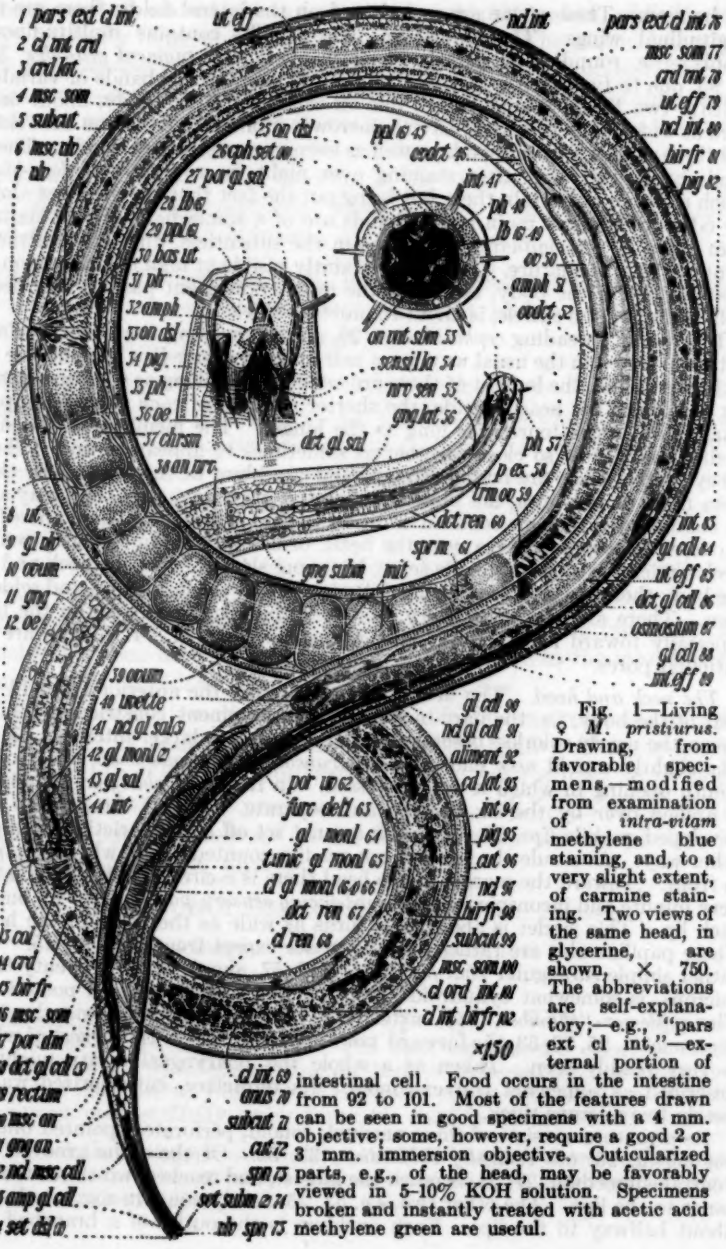


Fig. 1—Living ♀ *M. pristiurus*. Drawing, from favorable specimens,—modified from examination of *intra-vitam* methylene blue staining, and, to a very slight extent, of carmine staining. Two views of the same head, in glycerine, are shown, × 750. The abbreviations are self-explanatory;—e.g., "pars ext cl int,"—external portion of intestinal cell. Food occurs in the intestine from 92 to 101. Most of the features drawn can be seen in good specimens with a 4 mm. objective; some, however, require a good 2 or 3 mm. immersion objective. Cuticularized parts, e.g., of the head, may be favorably viewed in 5–10% KOH solution. Specimens broken and instantly treated with acetic acid methylene green are useful.

much elongated *unicellular salivary gland, e.g.* 43, and *dct gl sal*, located along the corresponding sector of the oesophagus and reaching back even to near the base of the neck, where the corresponding three nuclei, 41, may be seen, about one body-width in front of the prominent constriction, 13, separating the oesophagus from the intestine. Each gland empties through a perforation, 27, in the corresponding onchium, by means of an inconspicuous *ampulla* and a *very fine duct*,—about one micron across. The distribution of the salivary glands among the radial contractile fibers of the oesophagus may be indicated by the granules, one micron or less in diameter, to be seen in various parts of the glands, *e.g.* at *dct gl sal*. In favorable specimens the ducts of these glands, when filled with this granular secretion, can be followed throughout the length of the oesophagus, and the glands are then seen to have numerous short lateral branches, (see from 43 forward). The much larger, though inconspicuous *pigment granules of the oesophagus* are *scattered* throughout the organ.

The external *amphids*, 32, 51,—one on each side of the head,—are somewhat escutcheon shaped, being symmetrical only to a longitudinal line, and are longer transversely than longitudinally. The anterior border of each amphid is removed from the anterior extremity of the nema a distance about equal to the radius of the head. They are much more obvious if looked at dorso-ventrally, when they are distinctly seen to be two pocket-like entrances to internal sensory organs, the internal amphids, located laterad in the back part of the head. Each of the external amphids is about one-fourth as wide as the corresponding portion of the head and about two-thirds as long as it is wide. Each outer amphid connects with a *sensilla*, 54, or *receptor*, close behind, by means of an exceedingly narrow and very short (two and a half microns) but strongly refractive, duct, shown in the figure. The sensilla is one-fifth as wide as the head and lies opposite the basal part of the pharynx and is connected backward with the central nervous system by a lateral nerve, 55, just beneath the body wall. The details of the sensilla, 54, are usually difficult to see except when specially stained. The amphids are held to be chemical sense organs.

The *oesophagus*, 12, 36, is cylindroid, enlarging very slightly posteriorly; behind the pharynx it is three-fifths, at the nerve-ring one-half, and finally two-thirds as wide as the corresponding portion of the neck. The refractive membranous "triquetrous" *lining of the eosophagus*, mainly about one micron thick, but two microns in the axial parts, is a distinct feature throughout the organ, and finds *main optical expression* in what appear as two or three closely approximated refractive, often slightly sinuous, axial elements, and, in the ordinary closed condition of the oesophagus, seeming to occupy about one-eighth of its width. The radial *musculature of the eosophagus*, to be seen throughout its length, consists of fine strands and is accompanied by only a slight amount of yellowish granular matter. There are no cuticularized valves in the oesophagus.

The intestine. The *intestine*, 83, 94, which becomes at once two-thirds as wide as the body, is thick-walled and is composed, as is usual in nemas, of a *single layer of cells*, 69 and vicinity, here of such a size that about twelve are required to complete the circumference. The walls of the cells are only faintly visible except sometimes in the outer colorless part, 1, 76. Usually the lumen of the intestine, (see just behind cardia, 14) can be seen only faintly, since the lining of the intestine is not refractive. As the nema bends back and forth, the food content of the intestine, *e.g.* at 92, may be seen to move backward and forward in the lumen. This nema appears to swallow mud

rather indiscriminately, and to extract its nutriment from a variety of organic material contained in the mud. Large quantities of this food material in the intestine may interfere with microscopic examination; hence the advisability of keeping the nemas in clean cool seawater for a day or two before examination. The *cardiac collum*, or constriction, 13, between the oesophagus and intestine, is about two-fifths as wide as the base of the neck, making a very obvious demarcation between the oesophagus and the intestine. There is a conoid *cardia*, 14, about two-fifths as wide as the base of the neck; this is the very short extension of the oesophagus into the intestine, and is composed of numerous smaller cells of a distinct kind, having to do, among other things, with the prevention of regurgitation. Though small, the cardia is a very important part of the alimentary canal. The outer portion of the intestine, 1, 76, is usually more or less *destitute of granules*, but the inner and greater portion of each intestinal cell contains globular yellowish *granules*, 69, of variable size, the largest of which are about three microns in diameter, and the smallest less than one micron. These granules are varied and numerous, sometimes are even packed close together, and may be so arranged in the cells as to give rise to a faint, or sometimes a quite distinct, tessellated effect.

The intestine is made up of *cells of different kinds*,—discharging different functions. One of these various kinds is readily made out, especially with the aid of polarized light, namely the cells, as many as one hundred in number or even more, containing the exceedingly minute *birefringent granules*. These cells, 15, 81, 98, when examined by ordinary transmitted light, present a finer texture internally, and usually are more distinctly yellowish. If a suitable specimen be allowed to remain in a concentrated solution of seawater-methylene-blue a few minutes, a differential staining of the "birefringent" cells will often occur, but the effect does not last. The "birefringent" cells are everywhere less numerous than those that do not contain birefringents, and there are *none of them at all* in the posterior part of the intestine. We may therefore speak of two distinct intestinal regions, one fore, one aft. The "birefringent" cells occur in early ovic embryos.

The rather prominent short *rectum*, 19, the rear part of the intestine, is somewhat cuticularized, and is about as long as the anal body diameter; from the somewhat depressed *anus*, 70, it extends inward and forward at an angle of about forty-five degrees. Its structure in the female differs somewhat from that of the male, which appears "helical." The anterior and posterior lips of the anus are of about equal size. Small inconspicuous somewhat pear-shaped unicellular *anal glands* can sometimes be seen, lying alongside the rectum with their narrowed necks directed toward the anus.

Tail and spinneret. The slightly arcuate *tail* is first conoid, then cylindroid in the posterior fourth, where it ends in a somewhat blunt, almost imperceptibly swollen, rounded spinneret, 73, armed only with three exceedingly inconspicuous setae, two ventrally submedian, 74, and a dorsal one, 24. Though insignificant in appearance these sensory setae are important. The very nearly symmetrical spinneret displays internally the three very slightly swollen *ampullae of the three caudal glands*, 23. The *spinneret valve*, or plug, 75, four microns across, almost at the very end of the tail, stains green with methylene blue ("intra vitam") while other nearby parts stain blue. This *important valve* is hemispherical posteriorly and tapers anteriorly to a fine *contractile element*, shown white in the drawing, fastened in the midst of the three ampullae (23). It is by the contraction of this minute fiber that the plug or valve is pulled away from its seat, so as to permit the sticky, non-water soluble,

cement-like secretion of the three caudal glands to pour outward to be used in temporarily cementing the nema by the tail to the substratum in a versatile manner. The spinneret and associated glands are of vital importance to aquatic nemas; and this apparatus is all but universal among them. The three elongated ellipsoidal *caudal glands*, 84, 88, 90,—the remotest of them ten body-diameters in front of the anus,—are scattered in a loose tandem in the ventral part of the body cavity. Their ducts, 18, 86, leading to the spinneret, can be distinctly seen under some circumstances. Most of the caudal setae on the female are reduced and inconspicuous.

It is the sticky nature of the secretion of the caudal glands that enables these nemas to ensconce themselves so securely in the midst of the elements of the mud in which they live. By its aid they attach themselves to the substratum, especially in times of danger, and to each other. By means of this cement, they bind themselves together with mud etc. in almost inextricable tangles.

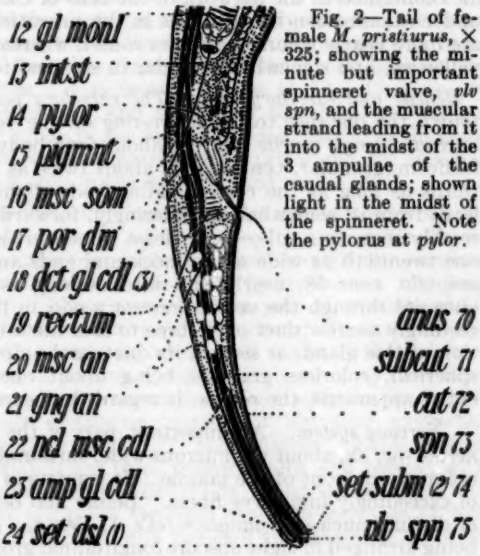


Fig. 2—Tail of female *M. pristiurus*, × 325; showing the minute but important spinneret valve, *vlv spn*, and the muscular strand leading from it into the midst of the 3 ampullae of the caudal glands; shown light in the midst of the spinneret. Note the pylorus at *pylor*.

The two very thin ribbon-like lateral cords, 3, 93, of *Metoncholaimus pristiurus*, one on each side, immediately under the cuticle, are about half as wide as the body, each cord consisting of three regions,—a median region composed of a single broad row of quadrate cells, and a row, less than half as wide, on each side of it. In the anterior part of the body the quadrate cells are usually a little longer than they are broad, in the posterior part a little shorter than broad. As stated, these median cells are flanked by two much narrower longitudinal series of cells, having the same general composition, *i.e.* a very fine protoplasmic network (meshes two microns to five microns) in the intersections of which are roundish or somewhat ellipsoidal yellowish granules, usually not equidiametral. Even without staining, there are also to be seen, at least in each of the cells composing the central row of the lateral cord, faint indications of a nucleus; these indications in the living nema consist in an almost entire absence of the reticulation which is to be found elsewhere in the cell. These cells of the lateral cord are necessarily very flat; that is to say, their depth (radially to the nema) is much less than their diameter in either of the other two directions,—*i.e.* longitudinally to the nema or tangentially. The division line between the central row of cells and the narrower ones on the margin is an almost invisible, very thin, somewhat indirect cell-wall line. Around the outer margins of the two outer rows of cells the granules are slightly *differentiated* from the other granules; so that in

seawater-methylene-blue the subcuticular pigment granules on the *borders of the longitudinal bands*, already described in connection with the *cuticle*, may stain green at a time when the rest of the granules stain blue. This appearance is similar to what is now being described for the unstained nema; so that the structure of the lateral cords is now shown to be in harmony with that of the longitudinal bands of subcuticular pigment. In other words, the arrangement of the pigment granules of the cuticle is doubtless in some way correlated with the arrangement of the cells in the lateral cords beneath. The protoplasmic network in the cells of the lateral cords is considerably finer than the protoplasmic network in the outer part of the cells composing the intestine, but nevertheless, has the same general appearance. The lacunae among the strands of the network are of variable size, more or less equidiametral, though never exactly so;—polygonal, but not regularly so. The lateral cords are wellsprings of the cuticle.

The granules of the subcuticle, 34, 82, 95, differ from the yellowish granules contained in the network of the cells of the lateral cord; in the specimen under examination the granules in the subcuticle (a little under one micron) are more nearly colorless and are round, whereas those in the lateral cord are yellowish, and somewhat irregular in size and form.

Renette and excretory pore. *The excretory pore*, 58, is located about one-fourth the distance to the nerve-ring on the ventral side of the neck. The *nucleated single renette cell*, 68, about four body-widths behind the neck, is a fusiform, granular, ventrad cell, about twice as long as wide, and nearly two-thirds as long as the corresponding body diameter; the *renette duct*, 60, 67, leads from it, somewhat meanderingly, forward to the excretory pore, and is readily seen, as a rule,—or at least some of it is. It is a slender tube about one-twentieth as wide as the neck and ends anteriorly in a small ellipsoidal *ampulla*, near 58, nearly one-third as long as the neck is wide, emptying outward through the ventral *excretory pore* in the cuticle by means of an exceedingly narrow duct only three to four microns long. The excretory secretion of this gland, as seen in its duct, and ampulla, is granular, the uniform, spherical, colorless granules being about one micron in diameter. This entire apparatus, the *renette*, is regarded as excretory in function.

Nervous system. An important part of the central nervous system is the *nerve-ring*, 38, about ten microns wide, surrounding the oesophagus somewhat obliquely in front of the middle. It consists of a compact network, or skein, of exceedingly fine nerve fibers. Before and behind the nerve-ring are scores of distinct nucleated *ganglion cells*, 11, 56, *etc.*, mostly bipolar, those in front being arranged in eight obscure longitudinal groups,—two lateral, one ventral, one dorsal, and four submedian. The ganglion cells are variously connected with each other and with the nerve-ring. Placing the nema over night in seawater-methylene-blue discloses some of the elements of the *ventral nerve* leading from the nerve-ring along the ventral line to the tail. Usually about 128 fusiform elements in the ventral series may be disclosed (stained blue) in this way. These can be proved to be connected with each other. The same treatment is likely also to reveal the nerve elements entering the bases of setae, and papillae, especially in the tail of the male. See Fig. 4.

Female organs. From the slightly elevated *vulva*, 7, which is a transverse ventral slit of moderate size, the medium sized *vagina* leads inward and slightly forward about halfway across the body; the vagina is somewhat cuticularized and is accompanied by small and very inconspicuous *vaginal glands*, 9, fore and aft. About two dozen *radiating muscles*, 6, occur around the

vulva, together with an associated complicated nerve plexus. This musculature is least developed behind the vulva.

The straight *uterus*, 30, 8, extends forward, and is of such capacity as to accommodate a maximum of about forty *eggs*, 10, 39, (i.e., many more than shown in this drawing) arranged approximately single file,—although this large number of eggs is rarely seen except toward autumn. Under such circumstances the oblate eggs, seeming to nearly fill the body cavity in this region, are more or less ellipsoidal in contour and half a body-width long, and twice as wide as long. When deposited, or when not crowded in the uterus, the eggs are ellipsoidal and longer than wide. The *shells* of the eggs, one and a half microns thick, are smooth, and the eggs are deposited *before segmentation* begins. Naturally, the length of the uterus varies according to the number of eggs it contains.

The broad *reflexed ovary* appears more or less cylindroid, and when there are, say, a dozen eggs in the uterus, the terminus of the ovary, 59, lies about halfway back to the vulva. The narrow *oviduct*, 46, 52, leading from the front end of the ovary back to the uterus, is usually nearly invisible, but when a ripe ovum, 50, having passed round the bend (flexure) near 46, is being forced backward through it from the front part of the ovary back to the uterus, its presence is obvious. It is faintly visible at 52. The ova are fertilized on first reaching the uterus, and soon after this it is not very uncommon to witness the early stages of the formation (*mit*, Fig. 1) of the *polar bodies*,—which appear later as small spherical bodies just under the eggshell. A small collection of sperms is seen in the spermathecal region at 61.

The demanian system. In the adult female of *Metoncholaimus pristiurus* there is a complicated double *system of efferent tubes*, the *demanian vessels*, connecting, first, with the posterior part of the intestine through an *osmosium*, 87, and second, with the posterior end of the uterus by means of a very long slender efferent duct, 79, 85. These two efferents join at a conspicuous thirty-two-merous, special glandular gateway,—the *uvette*, 40,—and empty, by way of the *uvette* pore, 62, thence backward and outward through two separate narrow lateral ducts, 42, having attached to them, *along their outer sides*, relatively large and long conspicuous *moniliform affluent glands*, 64, seventeen microns wide, each consisting usually of sixy-four somewhat discoid elements, 66,—occasionally double (?) this number. These discoid cells of the two moniliform glands are three microns thick and packed with granules of the order of one micron; the flat ducts, along the inside of the moniliform glands, lead to two *exit pores*, the right hand one shown at 17, five by seven microns, laterad in the body wall one-half tail-length in front of the anus. However, the caudad elements of the moniliform glands are "pyriform," as shown in the illustration,—not discoid. The demanian vessels elaborate a *copious, elastic, sticky, non-water-soluble, nearly colorless secretion*, possibly utilized during agglomeration and copulation, and also mayhap to protect and preserve the batches of eggs after deposition and during segmentation.

The uvette, 40, is a very striking organ consisting of thirty-two concentrically arranged, highly refractive, flask-shaped, glandular elements, all concentric about a single *minute central pore*, 62, leading into the large duct passing backward and dividing to form the two lateral efferent ducts each accompanied by a sixty-four-fold moniliform gland, as already described. The connection of the intestine with the demanian system at the osmosium is *not an open* one; the nature of the connection with the uterus, however, appears less certain.

The osmosium, 87, of the enteric efferent is located about one-third the distance from the anus to the vulva, and may usually be seen on the dorsal side of the intestine,—being mainly visible on account of the somewhat greater transparency of its tissues. The narrow uterine efferent duct, *ut. eff.*, 79, 85, is very difficult to follow throughout its length, and usually can be seen only in specially favorable specimens. Its connection with the posterior end of the uterus is sometimes easy to see,—near 30. Its connection with the uvette is also nearly always easy to see, and it may be followed thence forward a short distance, but to trace it far is usually a matter of some difficulty.

The thirty-two flask-shaped elements of the uvette have their *necks* concentrated at the pore. The wall of the uterine duct, as previously described, spreads out over the uvette, and beneath it the thirty-two elements form a craterlike affair leading to the uvette pore. This pore opens into the somewhat duplex (but really monoluminal) corridor of the caudad part of the intestinal efferent. This latter efferent may show signs of forking at a distance in front of the uvette about equal to the corresponding body diameter, but is seldom, if ever, really bifurcate until behind the uvette.

Or,—following the demanian system from the rear toward the uvette:—Where the moniliform glands approach the uvette, they join to form a two-fold structure, and the pore of the uvette is placed between the two parts of this double structure. The structure of the *tunic* of the demanian system opposite the uvette presents two sets of exceedingly fine symmetrically arranged elements,—one sloping 45° right, the other left,—which continue forward. This "spiral" structure can be seen throughout the duplex portion of the demanian system now being described, namely that portion in the vicinity of the uvette.

Sperms, 61, are to be seen at the cephalad end of the uterus *i.e.*, the *spermatheca*, where the oviduct joins the uterus, sometimes in a mass comprising scores of sperms, each about one-tenth as wide as the corresponding portion of the body. They are rather difficult to see except when they are present in considerable numbers.

MALE. Fig. 3.

The spicula and other male organs.

The tail of the male is more or less like that of the female in form, but is somewhat larger, more arcuate, and *far more flexible*, even prehensile, as Fig. 2 indicates. It diminishes a little more suddenly in size at the anus, and is armed with special setae and papillae. The two, equal, colorless, long and very slender, uniform *spicula*, 57, 58, seven times as long as the anal body diameter, are almost imperceptibly cephalated by expansion. They are simple and frail looking, their proximal ends lying more or less opposite the body axis. A long slender, duplex, nucleated *retractor muscle*, 16, extends forward from the proximal end of each spiculum to the body-wall in the corresponding subdorsal region, near 12; an antagonistic *protrusor muscle*, of about equal size *ensheaths* each spiculum. The small *inconspicuous gubernaculum*, 42, lying near the anus, is *double* and straight. Its two equal parts are somewhat frail and simple, but are expanded internally so as to be visible. They are only about half as long as the anal body diameter, and lie against the tips of the spicula in such a way that their swollen and more visible proximal ends, 42, lie nearly opposite the axis of the base of the tail.

There is a single inconspicuous *preanal ventral papilla*, 22, very close to the anus, 21, but readily seen when searched for. There are about ten small

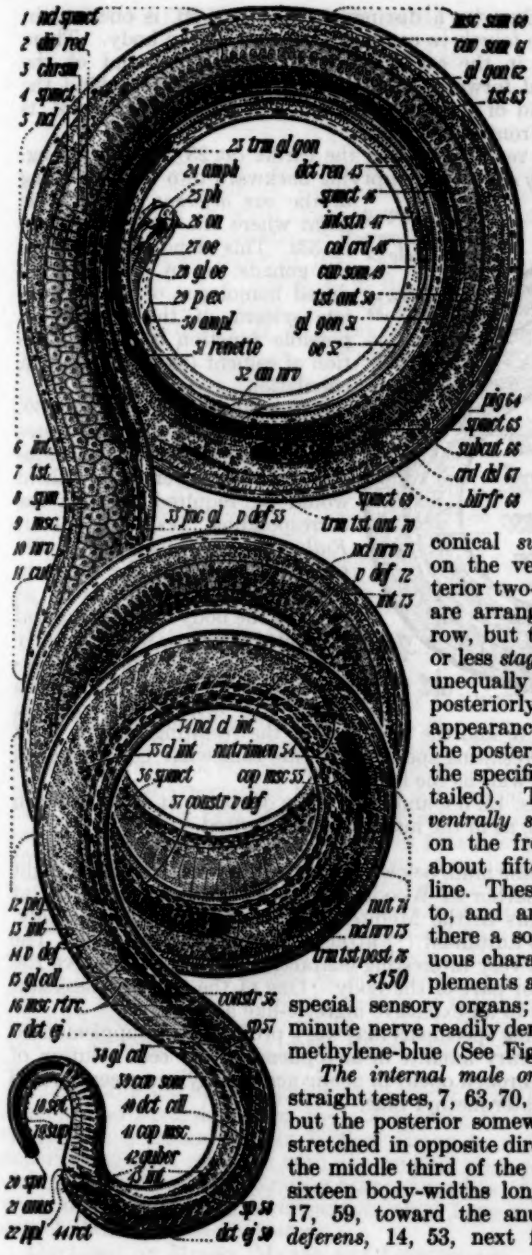


Fig. 3—♂ *M. pristiurus*, from balsam specimens; stain, acid carmen. Compare with Fig. 1. Here the nuclei are brought out more distinctly. The renette and caudal glands may be followed throughout. Development of the sperms can be followed; reduction division is shown at 2. The long gland accessory to the male gonads can be followed from 23 to 33. One of the exceedingly slender spicula is shown, together with its long duplex, nucleated retractor muscle. The oblique copulatory muscles of the male extend forward to near the vicinity of 74. The minute but important spinneret valve is shown at 20. The oesophageal glands shown at 28, may be profitably compared with the larger drawings in Fig. 1.

conical *supplementary organs*, 19, on the ventral and subventral posterior two-fifths of the tail. These are arranged in a sort of ventral row, but the anterior ones are more or less *staggered*; they are somewhat unequally spaced, being wider apart posteriorly. They give a serrated appearance to the ventral contour of the posterior part of the tail, hence the specific name, *pristiurus* (saw-tailed). There are also about thirty *ventrally submedian short setae*, 18, on the front portion of the tail, about fifteen on each subventral line. These two rows extend forward to, and around, the anus, forming there a sort of circlet of inconspicuous character. These conical supplements and setae of the male are special sensory organs; each is supplied with a minute nerve readily demonstrable with seawater-methylene-blue (See Fig. 4).

The internal male organs. The two slender, straight testes, 7, 63, 70, 76, of about equal length, but the posterior somewhat the longer, are outstretched in opposite directions, and extend along the middle third of the body, each being about sixteen body-widths long. The *ejaculatory duct*, 17, 59, toward the anus, is one-fifth; the *vas deferens*, 14, 53, next farther forward and set

off from the ejaculatory duct by a distinct constriction, 56, is one-fourth; and the testes average one-fourth to one-half;—as wide as the body. There is a constriction midway in the *vas deferens*, 37. The blind end of the *anterior testis*, 70, directed forward, is about two neck lengths behind the cardia, while the blind end of the *posterior testis*, 76, directed backward, is about five tail-lengths in front of the anus.

Beginning between the renette cell and the cardia (at 23) there is a long, straight, tapering *accessory gland*, 51, emptying backward into the beginning of the *vas deferens*, i.e., at the point where the two testes join it, 33. This gland, accessory to the gonads, is, no doubt, a reduced homologue of the demanian system of the female. A possible function is the production of cement (aseptic?) used in copulation.

Fig. 4—Tail end of *M. pristiurus*, Male × 325.

The primary *spermatocytes*, 69, near the blind end of the testes are about forty microns in diameter. About twenty of them would be required to span the corresponding body diameter. *Full grown spermatocytes*, 4, 36, occur farther along the testes in rouleaux, and are two-fifths as wide as the body of the nema and one-third as long as wide. Nearly simultaneous *synapses* and *reduction divisions* of a full grown sperm are often in progress in one or the other testis, 2, 3, and the members of the resulting *quartet*, 2, of smaller cells,—that is the resulting spermatids,—are somewhat equidiametral and are about one-fifth as wide as the body.

The three caudal glands, 15, 38, and their three ducts, as at 40, are shown more clearly when stained, as in the male specimen figured.

Habitat: Stagnant marine mud, below low tide, often where there is a slight overgrowth of eelgrass; harbor at Woods Hole, Massachusetts, U. S. A. at all seasons. It also occurs in the Mediterranean Sea, near Naples, Italy. This species is subject to autumnal (?) attacks of fungi and bacteria. The resulting diseases are of a very interesting character, and sometimes give rise to necrosis of the posterior part of the body. One of the common assailant cyanophytes(?) gives rise to an extensive aigrette-like appearance.

Examination of the living specimens may very profitably be supplemented by examination of temporary mounts in lactophenol, 5 per cent solution of potassium hydrate, and (broken open) in acetic acid-methylene green, as well as "intra-vitam" in seawater-methyl blue.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

1029TH MEETING

The 1029th meeting, constituting the 61st annual meeting, was held in the Cosmos Club Auditorium, December 7, 1931, President CURTIS presiding.

The treasurer reported expenditures of $1353.03 for the year, and stated that the active membership of the society is 240.

The secretaries reported that the following new members were elected during the year: A. V. ASTIN, L. E. BARBROW, H. F. BENNETT, C. BITTINGER, A. BLAKE, H. E. BURTON, L. F. CURTISS, F. T. DAVIES, I. A. DENISON, S. EWING, I. HARTMANN, H. D. HUBBARD, F. E. JOHNSTON, A. G. MCNISH, W. R. OSGOOD, B. L. PAGE, M. F. PETERS, J. D. PHOENIX, W. RAMBERG, H. F. SCHIEFER, G. B. SCHUBAUER, J. SMALL, P. SOLLENBERGER, W. T. SWEENEY, R. P. TEELE, M. J. WEST, R. C. WHEELER and J. E. WILLIS.

O. H. TITTMAN was transferred to life membership.

The following deaths were reported: F. W. CLARKE, A. J. HENRY, H. L. HODGKINS, F. G. TINGLEY.

During the year the first Joseph Henry lecture in memory of the first President of the Philosophical Society was given by JOSEPH S. AMES, President of Johns Hopkins University.

The following officers were declared elected for the year 1932: *President*, L. B. TUCKERMAN; *Vice Presidents*, O. S. ADAMS and H. L. DRYDEN; *Corresponding Secretary*, F. WENNER; *Treasurer*, E. W. WOOLARD; *Members-at-large of the General Committee*, N. H. HECK and E. O. HULBURT.

At the conclusion of the business meeting, E. C. CRITTENDEN read a paper on *The Faraday Centenary Celebration in Great Britain*.—The Faraday celebration held in Great Britain September 21 to 25 was intended primarily to mark the hundredth anniversary of the discovery of electromagnetic induction. Faraday's diary shows that on August 29, 1831, he observed a transient electric current in a coil wound on one-half of a ring of iron, when a current was started or interrupted in another coil wound on the other half of the ring. During the next few months he carried out and recorded a series of experiments which established the basic principles governing the creation of an electromotive force in a circuit by changing the magnetic flux through that circuit. The diary and much of Faraday's original apparatus was preserved at the Royal Institution where this work was done.

The Centenary Celebration was organized jointly by the Royal Institution and the Institution of Electrical Engineers. It was one of a series of affairs which filled the whole month of September. The series included an International Illumination Congress, a session of the International Commission on Illumination, the summer meeting of the Institution of Electrical Engineers and the centenary meeting of the British Association for the Advancement of Science.

The celebration itself included a number of receptions or "conversaziones," dinners and excursions, but the outstanding features of scientific interest were, first, a lecture by Sir William Bragg in which several of Faraday's experiments were repeated with the original apparatus, and, second a very elaborate exhibition illustrating many branches of Faraday's experimental work and the industrial developments which have grown more or less directly out of them. (*Author's abstract.*)

Discussed by Messrs. MYERS and LITTLEHALES.

G. R. WAIT, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

The degree of doctor of science has been awarded to Dr. LYMAN JAMES BRIGGS, assistant director of the Bureau of Standards, by his *alma mater*, Michigan State College.

At the recent annual convention of the American Malacological Union held in Washington, Dr. PAUL BARTSCH of the National Museum was elected to the presidency of the union.

The Hillebrand prize of the Washington section of the American Chemical Society has been awarded to Dr. G. E. F. LUNDELL of the Bureau of Standards in recognition of the outstanding merit of his book on analytical chemistry.

Obituary

Dr. NATHAN AUGUSTUS COBB, former president of the Academy, died suddenly in Baltimore on June 4, 1932, at the age of 72. Dr. Cobb was an authority on nemas, and a paper on this subject prepared shortly before his death appears in this issue of the Journal.

Born in Spencer, Mass., Dr. Cobb was educated at Worcester Polytechnic Institute and at the University of Jena in Germany, where he took honors under Haeckel, Hertwig, Lang, and Stahl. After obtaining his Ph.D. degree, he returned to teach for nine years in Massachusetts schools. He was then appointed by the British Association for the Advancement of Science to conduct work at its Naples zoological station, where he remained for two years. He then went to New South Wales, where he served in various capacities in the department of agriculture in that country for thirteen years. After three years in Hawaii, Dr. Cobb came to Washington to join the U. S. Department of Agriculture, becoming acting assistant chief of the Bureau of Plant Industry in 1911.

Dr. Cobb discovered and described about 1000 new species of animals and plants and was the author of 200 pamphlets and books. He was a member of the Washington Academy of Sciences, Helminthological Society of Washington, Botanical Society of Washington, American Society of Parasitologists, American Microscopical Society, American Association for the Advancement of Science, Medical Congress of Australia, Hawaiian Entomological Society, Australian Association for the Advancement of Science, and the New South Wales Linnean Society.